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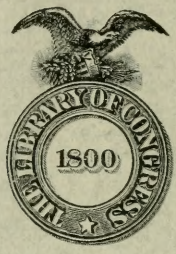

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THE WORK OF THE SCOTTSBLUFF RECLAMATION PROJECT EXPERIMENT FARM IN 1918 AND 1919

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UNITED STATES DEPARTMENT OF AGRICULTURE
DEPARTMENT CIRCULAR 173

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1921

Monograph

THE SCOTTSBLUFF EXPERIMENT FARM is located on the North Platte Reclamation Project, 6 miles east of Mitchell and about 8 miles northwest of Scottsbluff, Nebr. The farm includes 160 acres of land, and the work is supported cooperatively by the United States Department of Agriculture and the Nebraska Agricultural Experiment Station. Operations on this farm were begun in 1909.

In 1917 the Federal Government deeded to the University of Nebraska 800 acres of land located 5 miles north of the experiment farm, to be made a part of it, for the purpose of conducting grazing experiments.

Contribution from the Bureau of Plant Industry
(Office of Western Irrigation Agriculture)

WM. A. TAYLOR, Chief

Washington, D. C. June, 1921

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PROGRESS OF THE EXPERIMENTAL WORK.

This report presents the experimental data secured on the Scottsbluff Experiment Farm in Nebraska during 1918 and 1919 and describes in a brief way the agricultural development on the North Platte Reclamation Project.

Scarcity of farm help and high cost of operation have limited new lines of work, but the work previously undertaken has been continued and the results for two more years have become available. In some cases these results have been somewhat vitiated by the damage caused by grasshoppers.

The Scottsbluff Experiment Farm is maintained cooperatively by the United States Department of Agriculture and the Nebraska Agricultural Experiment Station, the work being divided into four general lines, as follows:

(1) General irrigated crop experiments.
(2) Rotation of crops under irrigation.
(3) Rotation and cultural operations with crops under dry-land conditions.
(4) Live-stock work.

In 1918 the last frost in the spring was on May 9, with a minimum temperature of 31° F., and the first frost in the fall on September 15, with a minimum temperature of 32° F., making a total frost-free period of 129 days. In 1919 the last frost in the spring was on June 2, with a minimum temperature of 30° F., and the first frost in the fall on September 21, with a minimum temperature of 32° F., making a total frost-free period of 111 days. The maximum tem-

perature in 1918 was 99° F. and the minimum 23° below zero. In 1919 the maximum was 101° F. and the minimum 33° below zero, which is the lowest temperature ever recorded at the experiment farm. A summarized statement of the climatological data is given in Table I.

The experimental work is conducted with the aim of obtaining information concerning local agricultural problems as well as the more general problems of crop production and crop utilization. During 1918 and 1919 it included: (1) Variety tests of the more important crops grown on the project, (2) cultural tests, (3) tests on the best time for thinning beets, (4) irrigation tests, (5) tests in crop rotation under irrigation, (6) the establishment of grass pasture, (7) fertilizing tests, (8) crop rotation and cultural operations under dry-land conditions, (9) pasturing tests with hogs, (10) pasturing tests with dairy cows, (11) steer-feeding tests, (12) lamb-feeding tests, and (13) dairy work.

The arrangement of the fields and the location of the experiments in 1918 and 1919 are shown in figures 1 and 2.

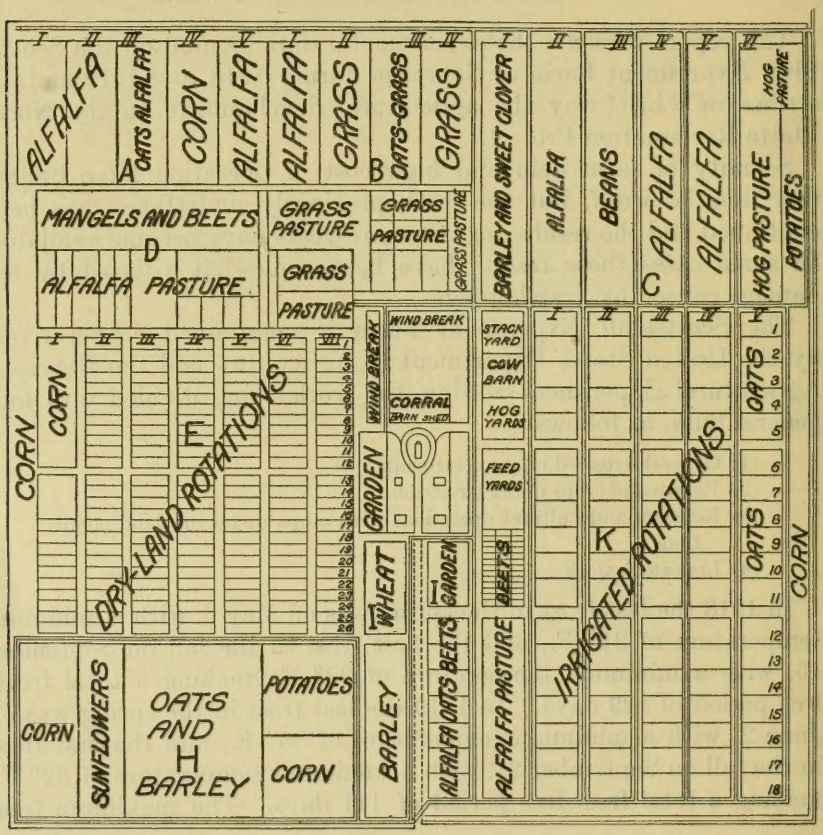

FIG. 1.—Diagram of the Scottsbluff Experiment Farm, showing the arrangement of the fields and the location of the experiments in 1918.

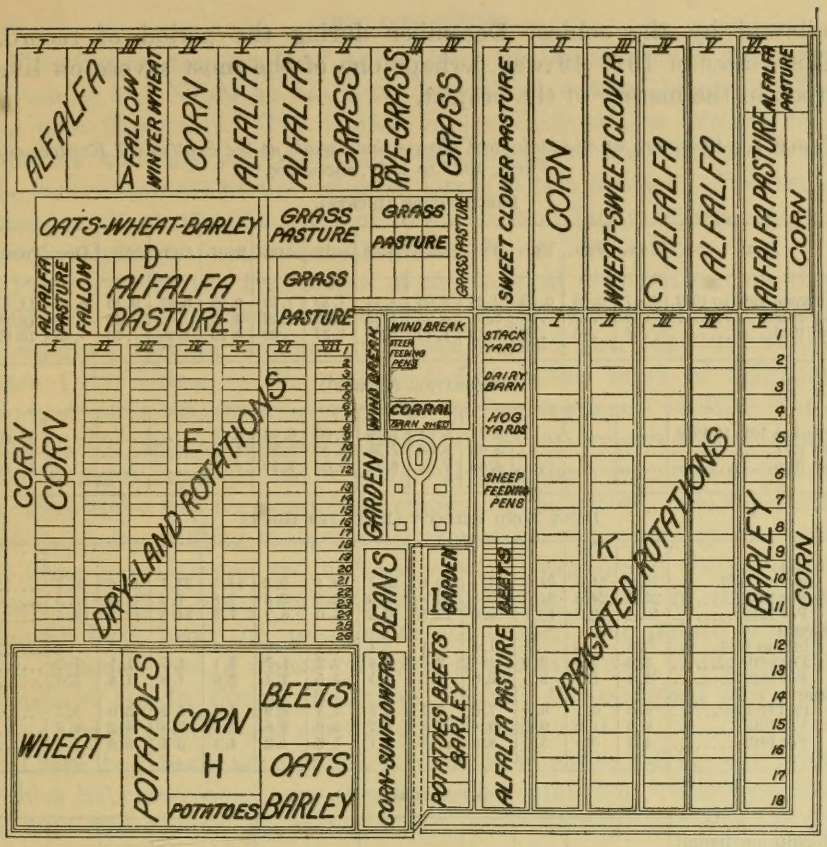

FIG. 2.—Diagram of the Scottsbluff Experiment Farm, showing the arrangement of the fields and the location of the experiments in 1919.

CONDITIONS ON THE NORTH PLATTE RECLAMATION PROJECT.

CLIMATE.

The weather conditions on the project during the summer of 1918 were very favorable for crop production. The rainfall was somewhat above normal, and the larger part of it fell during the early growing season when it was most needed for irrigated crops. The winter of 1917–18 was very mild and live stock wintered well. While the season of 1918 was one of the most favorable for crop production in the history of the project that of 1919 was the most unfavorable. In 1919 the precipitation was far below normal; particularly during the early season. The rainfall during April for the past nine years has averaged 2.26 inches, while in 1919 it was only 0.54 of an inch. In 1919 the total rainfall for April, May, and June was only 3.03 inches, while the 9-year average during this same period has been 6.66 inches, or more than twice as much. The weather was not only dry but unusually hot, the evaporation being higher than during any previous season. The hot summer was

followed by the coldest December during the period of record. The winter of 1918–19 was perhaps one of the most severe on live stock in the history of the project.

TABLE I.—*Summary of climatological observations made at the Scottsbluff Experiment Farm, 1911 to 1919, inclusive.*

PRECIPITATION (INCHES).

Item.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Average, 1911 to 1919	0.17	0.26	0.60	2.26	2.66	1.74	1.39	1.87	2.09	0.87	0.20	0.45	14.57
For 1918	.34	.27	.28	3.61	4.26	1.23	1.02	1.27	3.47	.69	.32	1.42	18.18
For 1919	.05	.45	.43	.54	1.45	1.04	1.37	.09	3.29	1.30	.70	.15	10.87

EVAPORATION (INCHES).

Average, 1911 to 1919	.....	.....	.....	4.71	6.31	7.49	7.90	6.88	5.10	.....	.....	.....	38.40
For 1918	.....	.....	.....	3.96	6.06	7.35	6.23	6.21	4.03	.....	.....	.....	33.84
For 1919	.....	.....	.....	4.64	7.63	8.13	9.09	8.17	4.87	.....	.....	.....	42.52

DAILY WIND VELOCITY (MILES PER HOUR).

Highest:													
1911 to 1919	29.9	24.5	24.2	31.4	16.6	16.7	9.1	9.2	11.5	23.1	15.6	16.7	.....
For 1918	29.9	24.5	24.2	20.3	12.0	9.9	6.9	5.6	9.8	7.4	11.2	10.5	.....
For 1919	10.1	15.8	10.1	19.0	12.5	10.2	8.0	6.7	7.3	14.5	13.8	14.5	.....
Lowest:													
1911 to 1919	.8	.4	.5	1.4	.1	.1	.4	.2	.1	.8	.5	.3	.....
For 1918	2.0	2.1	2.4	1.4	3.3	2.4	2.2	1.7	2.1	1.7	1.1	1.5	.....
For 1919	1.4	1.5	2.5	2.6	3.0	2.5	2.5	2.4	2.0	1.8	1.4	1.6	.....
Mean:													
1911 to 1919	6.2	6.1	6.8	7.6	7.1	5.8	4.3	3.9	4.4	5.2	5.0	5.4	.....
For 1918	9.9	11.2	9.2	9.4	7.3	4.7	3.9	3.8	4.3	3.8	4.2	4.6	.....
For 1919	4.2	5.4	5.6	8.8	7.3	6.1	5.3	4.2	4.1	5.4	5.5	5.5	.....

TEMPERATURE (° F.).

Absolute maximum:													
1911 to 1919	68	67	78	95	92	101	101	99	94	88	75	90	.....
For 1918	60	50	60	95	90	96	97	99	89	88	72	63	.....
For 1919	58	51	72	80	85	101	101	97	91	73	63	54	.....
Absolute minimum:													
1911 to 1919	−28	−23	−15	10	22	30	40	40	22	1	−21	−33	.....
For 1918	−23	−19	15	18	31	38	45	43	32	18	− 6	−10	.....
For 1919	−11	−17	5	14	29	30	51	42	32	16	−11	−33	.....
Mean:													
1911 to 1919	23	25	34	38	55	65	71	69	59	46	36	24	.....
For 1918	16	26	39	36	55	69	71	70	55	51	33	27	.....
For 1919	31	21	37	44	55	69	75	72	63	42	28	21	.....

KILLING FROSTS.

Year.	Last in spring.		First in autumn.		Length of frost-free period (days).
	Date.	Minimum temperature (°F.).	Date.	Minimum temperature (°F.).	
1911	May 26	28	Oct. 3	31	129
1912	May 13	30	Sept. 16	31	124
1913	May 2	26	Sept. 19	31	124
1914	May 7	32	Sept. 13	30	129
1915	June 12	32	Oct. 3	32	113
1916	May 2	24	Sept. 14	30	133
1917	May 21	32	Oct. 7	28	136
1918	May 9	31	Sept. 15	32	129
1919	June 2	30	Sept. 21	32	111

CROP CONDITIONS.

Farming on the irrigated lands along the North Platte River in Wyoming and Nebraska has gone through an unusual experience in the past five years. The United States Reclamation Service has reported annually as to the crop conditions on what is known as the interstate unit of the irrigated lands of this district. This unit includes about 100,000 acres of irrigated land fairly representative of a much larger area watered from the North Platte River.

Prior to 1915 the first stages of agricultural development on the interstate unit had been accomplished, and a substantial and fairly prosperous farming system had been worked out. In 1915 there were 1,100 farms on the unit, including 87,000 acres of irrigable land, of which 68,000 acres were reported as in crops. In 1919 there were 1,300 farms, including 98,000 acres of irrigable land with 85,000 acres reported as in crop. During the 5-year period ended in 1919 there was no significant change in the list of crops reported nor any very striking change in the proportion of the acreage devoted to these crops except an increase in wheat acreage in the last two years. Alfalfa, oats, sugar beets, corn, and wheat, in the order named, have been the most important crops. The potato acreage has exceeded that of wheat only once in the five years, though it has increased rapidly during that time. Alfalfa has occupied well over one-third of the cropped acreage all the time.

There has been no significant change in crop yields, but crop values have increased very rapidly. The total crop value reported in 1915 was slightly above $1,250,000, or an average value of $18.55 per acre. The increase in values has been continuous except for a slight depression in 1918, until in 1919 the total crop value was very little short of $4,000,000, or an average of $45.71 an acre.

These crop statistics throw some light on the rotations and farming practices that obtain in this region. It has been noted that alfalfa is, in point of acreage, the most important crop. This crop is valuable not only for hay and pasture but also in its effect on subsequent crop yields.[1] On the sandy soils of the North Platte Valley, the beneficial effect of alfalfa in the rotations is very striking, being nearly equal to that of an ordinary application of barnyard manure. While the full significance of this fact has probably not yet been appreciated by all the farmers on these lands, it is clear from the statistical returns that nearly one-fifth of the old alfalfa land is annually broken up and the producing acreage of this crop maintained by new seeding. Rather more than three-fourths of the new seeding is done with a nurse crop.

[1] Scofield, C. S. Effect of alfalfa on the subsequent yields of irrigated field crops. U. S. Dept. Agr. Bul. 881, 13 p. 1920.

Summaries of data concerning crops on the interstate unit for 1918 and 1919 are presented in Table II from statistics furnished by the United States Reclamation Service. Table III gives a digest of the acreage, yields, and farm values of the seven more important crops grown on the project from 1910 to 1919, inclusive.

TABLE II.—*Acreage, yields, and farm values of crops grown on the North Platte Reclamation Project (Interstate Unit) in 1918 and 1919.*

Crop.	Area (acres).	Unit of yield.	Yields.		Farm values.		
			Total.	Average per acre.	Per unit of yield.	Total.	Per acre.
1918.							
Alfalfa hay	37,863	Ton	66,713	1.8	$13.00	$867,269	$22.91
Alfalfa seed	136	Bushel	110	.8	10.00	1,100	8.08
Barley	3,550	do	106,080	29.9	1.10	116,688	32.87
Beans	1,800	do	13,133	7.3	4.50	59,098	32.83
Beets:							
Sugar	6,391	Ton	72,684	11.4	10.75	781,353	122.26
Stock	13	do	171	13.2	7.00	1,197	92.08
Clover (sweet) seed	94	Bushel	390	4.2	10.00	3,900	41.49
Corn	6,627	do	119,319	18.0	1.50	178,978	27.01
Corn fodder	351	Ton	838	2.4	4.00	3,352	9.55
Garden	347					14,905	42.95
Hay (other)	838	Ton	879	1.0	10.00	8,790	10.49
Millet seed	118	Bushel	617	5.2	1.50	925	7.84
Oats	7,997	do	168,990	21.1	.80	135,192	16.91
Onions	27	do	1,235	45.7	2.00	2,470	91.48
Pasture:							
Alfalfa	2,497	Acre			15.00	37,455	15.00
Other	618	do			5.00	3,090	5.00
Potatoes	6,203	Bushel	1,035,956	167.0	.60	621,574	100.21
Rye	721	do	8,363	11.6	1.25	10,454	14.50
Wheat	9,097	do	133,103	14.6	1.90	252,895	27.80
Miscellaneous	20					25	1.25
Total or average	85,308					3,100,710	36.35
1919.							
Alfalfa hay	33,446	Ton	70,109	2.1	15.00	1,051,635	31.44
Barley	3,720	Bushel	101,067	27.2	1.25	126,333	33.96
Beans	95	do	747	8.0	3.00	2,241	23.59
Beets:							
Sugar	10,968	Ton	116,310	10.6	11.00	1,279,410	116.65
Stock	29	do	384	13.3	6.00	2,304	79.45
Cane (sorghum)	181	do	325	1.8	4.00	1,304	7.20
Clover (sweet) seed	387	Bushel	717	1.9	18.00	12,906	33.35
Corn	9,107	do	157,899	17.3	1.30	205,009	22.51
Corn fodder	97	Ton	104	1.1	4.00	416	4.29
Garden	270					13,130	48.63
Hay (other)	616	Ton	647	1.0	10.00	6,470	10.50
Millet seed	289	Bushel	1,161	4.0	1.50	1,741	6.03
Oats	6,620	do	159,815	24.1	.80	127,852	19.31
Pasture:							
Alfalfa	2,390	Acre			15.00	35,850	15.00
Sweet clover	361	do			15.00	5,415	15.00
Potatoes	6,284	Bushel	713,257	113.5	1.00	713,257	113.50
Rye	859	do	5,771	6.7	1.25	7,214	8.40
Wheat	9,757	do	165,536	17.0	1.90	314,518	32.24
Miscellaneous	214					9,730	45.47
Total or average	85,690					3,916,736	45.71

The use of alfalfa as pasture, particularly for hogs, has continued to be an important feature of the cropping system. Though the number of hogs reported has declined during the 5-year period from an average of 20 per farm in 1915 to less than 9 per farm in 1919, the area of alfalfa pastured has declined only from 3,000 to 2,400 acres. The important field crops other than alfalfa grown on the interstate unit may be grouped into two classes, the food crops and

the feed crops. The first class includes sugar beets, wheat, potatoes, and beans, grown chiefly for sale. The second class includes corn, oats, and barley, chiefly fed on the farm where produced or sold for feeding local live stock.

TABLE III.—*Statistical summary of acreage, yields, and farm values of the principal crops grown on the North Platte Reclamation Project from 1910 to 1919, inclusive.*

Item and year.	All crops.	Alfalfa.	Beets.	Potatoes.	Corn.	Barley.	Oats.	Wheat.
Acreage:								
1910	42,362	3,707	283	3,854	5,207	1,138	11,419	9,597
1911	44,736	8,880	343	3,190	4,563	902	12,271	6,715
1912	50,250	19,512	667	1,192	6,260	1,156	10,093	4,390
1913	56,829	27,298	2,920	1,156	3,561	2,331	8,590	2,182
1914	60,532	32,464	5,083	1,097	6,024	2,261	7,017	609
1915	70,007	31,788	7,872	1,395	10,343	2,329	7,112	1,878
1916	75,620	32,601	9,024	1,735	6,715	4,857	10,375	2,617
1917	83,203	34,374	9,357	4,833	6,051	3,052	10,173	3,128
1918	85,308	37,863	6,391	6,203	6,627	3,550	7,997	9,097
1919	85,690	33,446	10,968	6,284	9,107	3,720	6,620	9,767
Production:		*Tons.*	*Tons.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
1910		7,763	1,126	139,440	15,806	8,545	151,773	85,127
1911		18,883	2,439	44,316	62,454	12,935	183,287	82,376
1912		42,604	7,132	121,392	96,821	31,064	295,360	75,354
1913		61,728	32,739	151,304	67,001	49,522	211,599	32,489
1914		71,405	53,282	159,027	93,186	53,022	146,211	9,979
1915		62,491	97,753	251,833	209,626	87,037	198,692	33,785
1916		59,706	92,104	274,100	125,911	106,096	191,204	28,207
1917		58,656	99,790	1,119,626	117,008	94,868	243,764	47,467
1918		66,713	72,684	1,035,956	119,319	106,080	168,990	133,103
1919		70,109	116,310	713,257	157,699	101,067	159,815	165,536
Average yield per acre:								
1910		2.0	4.0	39.0	3.0	8	13	9.0
1911		2.1	7.0	14.0	14.0	14	15	12.0
1912		2.2	11.0	102.0	15.0	27	29	17.0
1913		2.3	11.0	131.0	19.0	21	25	15.0
1914		2.2	10.5	145.0	15.0	23	21	16.0
1915		2.0	12.5	181.0	20.0	37	28	18.0
1916		1.8	10.2	158.0	19.0	22	18	11.0
1917		1.7	10.7	231.7	19.3	31	24	15.2
1918		1.8	11.4	167.0	18.0	30	21	15.0
1919		2.1	10.6	113.5	17.3	27	24	17.0
FARM VALUE.								
Per unit of yield:								
1910		$7.00	$5.00	$0.50	$0.35	$0.35	$0.40	$0.70
1911		6.00	5.00	.75	.60	.60	.50	.75
1912		5.00	5.60	.25	.40	.50	.35	.67
1913		5.00	5.50	.45	.70	.60	.40	.63
1914		4.50	5.50	.35	.75	.60	.40	.85
1915		5.00	5.50	.40	.50	.45	.40	.90
1916		7.50	6.26	.90	.70	.60	.50	1.20
1917		17.00	7.50	.80	1.50	1.20	.70	1.80
1918		13.00	10.75	.60	1.50	1.10	.80	1.90
1919		15.00	11.00	1.00	1.30	1.25	.80	1.90
Per acre:								
1910	$6.47	14.66	19.90	18.09	1.06	2.62	5.32	6.21
1911	8.67	12.76	35.55	10.42	8.21	8.60	7.47	9.20
1912	11.04	10.92	59.88	25.46	6.19	13.44	10.24	11.50
1913	14.40	11.31	61.67	58.90	13.17	12.75	9.85	9.38
1914	14.95	9.90	57.65	50.74	11.60	14.07	8.33	13.93
1915	18.55	9.83	68.30	72.21	10.13	16.82	11.18	16.19
1916	21.85	13.74	63.79	142.18	13.13	13.10	9.21	12.93
1917	41.92	29.00	79.99	185.33	29.01	37.30	16.77	27.31
1918	36.35	22.91	122.26	100.21	27.01	32.87	16.91	27.80
1919	45.71	31.44	116.65	113.50	22.51	33.96	19.31	32.24
Total:								
1910	274,217	54,341	5,630	69,720	5,532	2,990	60,709	59,588
1911	388,225	113,298	12,195	33,237	37,472	7,761	91,643	61,782
1912	521,455	213,020	39,939	30,348	38,728	15,532	103,376	50,487
1913	786,619	308,640	180,064	68,086	46,900	29,713	84,639	20,468
1914	890,202	321,322	293,051	55,659	69,889	31,813	58,484	8,482
1915	1,263,616	312,455	537,641	100,733	104,813	39,166	79,476	30,406
1916	1,633,389	447,795	575,650	246,690	88,137	63,657	95,602	33,848
1917	3,385,059	997,152	748,425	895,700	175,512	113,841	170,634	85,440
1918	3,100,711	867,269	781,353	621,573	178,978	116,688	135,192	252,895
1919	3,916,736	1,051,635	1,279,410	713,237	205,008	126,333	127,852	314,518

During the 5-year period under consideration, the area devoted to the food crops has increased from 11,000 to 27,000 acres, or 2½ times. The area devoted to the feed crops has fluctuated slightly, but has been about 20,000 acres each year, although the total cropped acreage of the unit has increased during the five years by nearly 18,000 acres.

LIVE STOCK.

While in some lines the live-stock industry on the project shows a slight increase, in others it shows a marked decrease. There was an increase in the number of horses in 1918 over that of 1917, but in 1919 came a slight decline. Beef cattle continued to decrease through both years, while dairy cattle made a slight but steady increase. Sheep in the form of farm flocks made a substantial increase. The greatest decrease was in the number of hogs, which fell from 25,123 in 1916 to 11,200 in 1919. Both fowls and bees increased.

The feeding of live stock has declined. In 1918 only 28,000 lambs were fed, while during the three previous years the number fed each winter did not fall below 80,000. A good profit was made on those fed in 1918, which stimulated the feeding the following winter, when 56,000 lambs were fed with very satisfactory profits. While the number of cattle fed decreased slightly, the number is more constant than in the case of lambs. Cattle feeding was not very profitable during the winters of 1918–19 and 1919–20. A summary of the live-stock industry is given in Table IV, compiled from the records of the United States Reclamation Service.

TABLE IV.—*Number of live stock on the North Platte Reclamation Project during the 9-year period from 1911 to 1919.*

Year.	On hand at the close of the year.							Brought on for feeding.		
	Horses.	Cattle.		Sheep.	Hogs.	Fowls.	Bees (hives).	Sheep.	Cattle.	Horses.
		Beef.	Dairy.							
1911	2,722	2,179		2,000	7,000	2,000	50	25,000	.....	.....
1912	3,329	1,866		2,000	9,123	3,000	80	55,000	.....	.....
1913	3,785	1,640	1,326	5,000	14,286	37,620	315	63,000	3,000	.....
1914	4,618	1,669	1,521	605	22,143	43,898	476	75,000	4,700	700
1915	5,910	4,723	2,218	2,254	24,928	46,971	630	83,000	3,000	500
1916	6,398	5,010	3,040	1,401	25,123	59,249	764	83,500	4,600	500
1917	6,800	6,035	3,345	1,000	16,550	56,015	517	80,000	5,400	500
1918	7,732	5,100	3,400	3,700	15,250	61,800	632	28,000	4,200	800
1919	7,427	4,000	3,500	3,500	11,200	65,480	651	56,000	5,300	200

It is very obvious why the hog industry has declined. Even on the corn-belt farms the corn fed to hogs could have been put on the market at a higher profit. And corn for hogs on the irrigated farms involved also the cost of freight on the corn and the commission of the middlemen. The alfalfa pasture of the irrigated farms could not

replace enough of this high-priced corn to show a profit. As a consequence, farmers in many cases have closed out their hogs. Under normal conditions this section with its abundance of alfalfa pasture and its more favorable farrowing season can compete very favorably with the corn belt in raising hogs.

While the number of dairy cows on the project shows but a slight increase, it is perhaps true that the cows are better distributed. The tendency seems still to be to have a few cows on each farm rather than large dairy herds. Where a few dairy cows are kept on the farm they furnish a ready market for the surplus hay and other roughage. They also supply a cream check each month which goes a long way toward paying the grocery bill, and if the number of cows is not too great their care will not interfere materially with the general field operations. There is perhaps less risk of financial loss with a small herd of dairy cows than with any other form of live stock.

CROP EXPERIMENTS.

ALFALFA.

As the summer of 1919 was long and unusually hot the yields of alfalfa where it had sufficient water were above normal. Many fields however, suffered from a lack of moisture. In many cases where the fields did not receive sufficient water to give the alfalfa a quick start after being cut, the grasshoppers ate it off nearly as fast as it came on, so that on these fields the yield was far below normal. Perhaps the greatest damage done to this crop by grasshoppers was to the new seeding.

COMPARISON OF SPRING SEEDING AND FALL SEEDING.

In the irrigated rotation experiments eight plats of alfalfa are seeded each year, five plats in the spring on beet land and three plats in the fall in oat stubble. In most years the fall seeding is completed before the end of August. In each case the alfalfa is seeded with a disk drill. The stubble is left standing as a winter protection for the young alfalfa. The yields from each of these seedings and from the plats on which the alfalfa is 2 or 3 years old, are given in Table V.

TABLE V.—*Spring seeding of alfalfa on beet land in 1919 compared with fall seeding in oat stubble in 1918 and for a 6-year period on the Scottsbluff Experiment Farm*

Crop.	Number of plats.	Yield per acre (tons).			
		Season of 1919.			6-year average, 1914 to 1919.
		Maximum.	Minimum.	Mean.	
Spring seeded	5	3.57	2.5	2.85	1.51
Fall seeded	3	2.10	0.0	1.10	3.21
Old alfalfa (second and third year)	11	7.75	2.11	5.25	5.22

Up to 1917 the fall seeding of alfalfa in grain stubble had been very successful and the yield the following summer had averaged but little less than from well-established stands. The fall seedings of 1917, 1918, and 1919, however, were almost complete failures, because of the damage done by grasshoppers. When grasshoppers are numerous it is very likely to be a waste of time and seed to sow alfalfa in the fall. While fall seeding and spring seeding with a nurse crop have proved failures during the grasshopper years, the alfalfa that was seeded alone in the spring on beet land has given very good stands. It is clear that grasshoppers will not damage young alfalfa as much when growing among weeds as they will when it is grown with a grain crop. Seeding alfalfa in the spring without a nurse crop is justified only as a means of avoiding grasshopper injury. When the crop is seeded alone in the spring on old land weeds become very troublesome. They retard the growth of the alfalfa as much as a grain crop would if seeded as a nurse crop, and the grain crop is far more profitable than weeds. The hay cut from the spring and fall seeding in 1919 was of very poor grade, having a large percentage of weeds and grass.

PASTURING ALFALFA WITH HOGS.

The hog-pasturing experiments conducted in 1917 were continued during the summer of 1918. There were four lots of 10 hogs each. Lots 1 and 2 each had access to 1 acre of alfalfa, while lots 3 and 4 each had access to half an acre. Lot 1 differed from lot 2 in that the whole pasture for lot 1 was cut for hay every 30 days, while alternate halves of the pasture for lot 2 were cut every 15 days. Lot 3 differed from lot 4 in that the pasture for lot 3 was divided and the hogs were alternated from one to the other, while the pasture for lot 4 was not divided.

Each lot was fed a 2 per cent corn ration during the first two and one-half months, and during the last part of the pasturing season the corn was increased to a 3 per cent ration in 1917. In 1918 each lot had access to a self-feeder.

The experiment began early in May, as soon as the alfalfa was large enough to graze, and continued for 107 days in 1917 and 135 days in 1918. The average initial weight of the hogs was 105 pounds for those used in 1917 and 84 pounds for those used in 1918. The average final weight varied from 241 pounds in lot 1 to 223 pounds in lot 4 for 1917 and from 248 pounds in lot 1 to 221 pounds in lot 4 for 1918.

Because the season was cold and backward in 1917, and the grasshoppers very troublesome in 1918, the yield of alfalfa was not up to normal. As a result but little hay was harvested from pastures 1 and 2, and pastures 3 and 4 were at times overpastured, particularly

pasture 4. The average of the results for the two years is given in Table VI.

TABLE VI.—*Results obtained by pasturing hogs in lots of 10 each on alfalfa on the Scottsbluff Experiment Farm in 1917 and 1918.*

Items of comparison.	1-acre pasture.		Half-acre pasture.	
	Lot 1.	Lot 2.	Divided, lot 3.	Not divided, lot 4.
Total gains made.....pounds..	1.495	1.478	1.422	1.297
Total corn fed.....do....	5.286	5.303	5.275	5.319
Corn fed per pound of gain.....do....	3.54	3.59	3.71	4.10
Hay harvested.....tons..	.72	.73	None.	None.
Financial statement:				
Total cost of corn, at $1.07 per hundredweight.....	$56.67	$56.74	$56.44	$56.91
Total value of gains, at $7 per hundredweight.....	104.65	103.46	99.54	90.79
Net return.....	47.98	46.72	43.10	33.85
Value of hay, at $8 per ton.....	5.76	5.84	.....	.....
Net return of pasture per acre.....	53.74	52.56	86.20	67.70

The results shown in Table VI indicate (1) that the differences in lots 1 and 2 were very slight, (2) that lots 1 and 2 consumed the greater part of the forage from the 1-acre pastures, (3) that lots 3 and 4, especially lot 4, suffered a shortage of feed due to overpasturing, and (4) that a divided pasture furnishes more forage than a pasture of the same area not divided.

The financial statement in Table VI is based on 60 cents per bushel for corn, $8 a ton for hay, and $7 per hundredweight for gains in the weight of hogs. This is the scale of prices used in reporting previous experiments. The actual prices were very much higher at the time the experiments were conducted. The average cost of corn during the summer of 1917 was $3.50 per hundredweight, and during the summer of 1918 corn cost $3.25 per hundredweight. The hogs were sold on the Denver market. Those sold on September 3, 1917, brought $18.35 per hundredweight, and those sold on September 24, 1918, brought $20 per hundredweight. With these actual prices the returns are higher than when the results are calculated on the basis of normal prices.

In 1917, when the hogs were charged $3.50 per hundredweight for corn and $30 an acre for alfalfa pasture and credited $17 per hundredweight for the gains made, the net profit per hog was $4.23 for those in lot 1, $3.72 for those in lot 2, $4.27 for those in lot 3, and $2.69 for those in lot 4. In 1918, when the hogs were charged $3.25 per hundredweight for corn and $30 an acre for alfalfa pasture and credited $18.50 per hundredweight for the gains made, the net profit per hog was $7.48 for those in lot 1, $7.33 for those in lot 2, $8.07 for those in lot 3, and $4.80 for those in lot 4.

These results show that alfalfa pasture at $30 per acre is a cheap feed compared with $3.25 per hundredweight for corn. It is there-

fore economy to give the hogs plenty of pasture to save corn. In this test the hogs that had access to unrestricted pasture were fed 356 pounds of corn for each 100 pounds of gain, and this gain was made during the finishing period, which required more corn than during the growing period. While it is highly desirable that the hogs have plenty of pasture, it is not good practice to let hogs have the run of a large field that is to be harvested for hay.

COMPARISON OF LIMITED AND UNLIMITED GRAIN RATIONS FOR HOGS ON ALFALFA PASTURE.

The pasturing test here described has been conducted but one season. There were three lots of 10 shotes each. Lots 1 and 2 had access to 1 acre of pasture not divided, and lot 3 had access to half an acre which was divided. Lot 1 was fed corn from a self-feeder, while lots 2 and 3 were fed about a 2 per cent ration during the first 60 days, and then the corn ration was gradually increased to 3 per cent at the end of 90 days; they were given access to a self-feeder during the last 30 days.

TABLE VII.—*Results obtained from hogs in lots of 10 each on alfalfa pasture in 1919.*

Items of comparison.	Self-feeder, 1 acre, not divided, lot 1.	Limited grain ration.	
		1 acre, not divided, lot 2.	One-half acre, divided, lot 3.
Duration of test.....days..	90	120	120
Total initial weight.....pounds..	1,250	1,194	1,202
Total gains made.....do....	1,475	1,256	1,158
Total corn fed.....do....	5,383	4,376	4,611
Corn fed per pound of gain.....do....	3.65	3.48	3.98
Hay harvested.....tons..	1.84	1.19	None.
Financial statement:			
Total cost of corn at $1.07 per hundredweight	$57.60	$46.82	$49.34
Total value of gains at $7 per hundredweight	103.25	89.22	81.06
Value of hay at $8 per ton	14.72	9.52	None.
Net return of pasture per acre	60.37	51.92	63.44

When normal prices are used the financial statement in Table VII shows a profit, but when actual prices are used each lot shows a loss. During the summer of 1919 the price of corn varied from $3.25 to $4 per hundredweight. The average price of the corn fed to these hogs was about $3.85 per hundredweight. The shotes were sold on the Denver market on September 6, 1919, at $16.25 per hundredweight. When the hogs are charged $3.85 per hundredweight for corn and $30 an acre for alfalfa pasture and credited $15 per hundredweight for the gains made, the loss per hog is $1.60 for those in lot 1, $1.01 for those in lot 2, and $1.88 for those in lot 3. This does not represent the total loss, however. The hogs used in this experiment cost $19 per hundredweight at the beginning of the experiment. When the original cost of the shotes is considered, the hogs in lot 1 each lost

$6.60, those in lot 2 $5.78, and those in lot 3 $6.69. If labor, interest, and risk are considered the losses would be still greater.

ROTATION TEST FOR ALFALFA HOG PASTURE.

The third-year alfalfa plat in rotation 65 is pastured by hogs. The grazing season is divided into two periods, fall-farrowed shotes being used in the first period and spring-farrowed hogs in the second period. The plat covers a quarter of an acre and is divided into two parts, which are grazed alternately. The hogs are fed a 2 per cent ration of corn while on pasture. The results for 1919 compared with a 7-year average, all figured to the basis of 1 acre, are shown in Table VIII.

TABLE VIII.—*Results of pasturing alfalfa with hogs in 1919 compared with the average for the 7-year period from 1913 to 1919, inclusive.*

Items of comparison.	Season of 1919.			7-year average.
	Spring period.	Summer period.	Total.	
Number of hogs pastured	24	40	.....	.....
Total initial weight.....pounds..	1,812	2,560	.....	.....
Total gains made.....do....	1,292	1,900	3,192	3,104
Total corn fed.....do....	3,880	4,636	8,516	7,813
Corn fed per pound of gain.....do....	3.00	2.44	2.67	2.48
Financial statement:				
Net return from pasture	$48.03	$83.40	$131.43	$133.69
Cost per hundredweight of gain, pasture at $15, corn at $1.07 per hundredweight	3.77	3.03	3.32	3.18

When the value of the gains made is figured at $7 per hundredweight and the corn fed at 60 cents per bushel, the net return per acre of alfalfa pasture is $48.03 for the first and $83.40 for the second period, making a total of $131.43 for the season. On the same basis, the average net return for seven years is $133.69 per acre. Alfalfa plats comparable to the plat pastured gave an average yield of 5.25 tons per acre for the season. On the basis of this yield, the hogs paid the equivalent of $25.03 per ton for the 1919 hay crop. The average yield for seven years of alfalfa plats similar to those pastured was 5.22 tons per acre. At this rate the hogs returned annually a value of $25.61 per ton for the hay harvested in the field. The average weight of pork produced per acre for the 7-year period is 3,104 pounds. It required 248 pounds of corn in addition to the alfalfa pasture to produce 100 pounds of pork.

COMPARISON OF TURKESTAN AND COMMON ALFALFAS.

Results previously reported from this farm make it clear that hogs show a very decided preference for Turkestan alfalfa over the common variety. With this information at hand an experiment was made to determine whether Turkestan alfalfa has a greater carrying

capacity or a higher nutrition value than common alfalfa. During the summers of 1918 and 1919 a quarter-acre plat of each of these varieties was pastured by hogs. The lots of hogs were uniform and received the same allowance of corn. In 1919 the hogs on the Turkestan alfalfa made 763 pounds gain, while those on the common alfalfa made 764 pounds gain. For each pound of gain made the hogs on Turkestan alfalfa were fed 2.64 pounds of corn and those on common alfalfa 2.77 pounds of corn. The results in 1918 were consistent with those of 1919. The average results for the two years show that hogs on Turkestan alfalfa made 637 pounds gain and those on the common alfalfa 663 pounds gain. For each pound of gain made the hogs on Turkestan were fed 3.12 pounds of corn and those on common alfalfa 3.02 pounds. These results show that Turkestan alfalfa does not have any advantage over common alfalfa as a pasturing crop for hogs.

PASTURING SHEEP ON ALFALFA.

During the summers of 1917, 1918, and 1919 a small flock of breeding ewes and lambs was pastured on alfalfa. In 1917 there were no losses from bloat. In 1918 four in a flock of about 30 died from bloat, and in 1919 three died from bloat. From the experience of these three years it does not seem advisable to pasture sheep on alfalfa. While the gains are very satisfactory, the risk is too great.

SWEET CLOVER FOR PASTURE.

Sweet clover is proving a very satisfactory pasture crop on the North Platte project. While there are cases of cattle bloating from eating sweet clover, it is not nearly so dangerous as alfalfa. There has never been a case of bloat from eating sweet clover at this station. During the summer of 1919 3 acres of sweet clover that had been seeded with wheat in the spring of 1918 were pastured by 10 dairy cows. The cows were turned into the pasture on May 1 and the number mentioned were kept on the 3 acres continuously until the last of September. These 10 cows were unable to keep the pasture grazed down. Of these cows 4 gave milk and were kept in the yard at night and fed alfalfa hay, while the others were kept on the pasture day and night. The pasture was divided, and the cows were alternated from one part to the other every 10 days or 2 weeks.

The 4 cows that gave milk were changed to grass pasture, and 4 cows from grass pasture were changed to the sweet-clover pasture every two weeks. The cows were weighed at each change and a record of the yield of milk was kept. There was practically no difference in the milk flow when the cows were changed from one pasture to the other; if any slight difference was perceptible, the average for the season was in favor of the sweet clover. In weight, the cows held up fully as well when on sweet clover as on grass pasture.

As a pasture crop sweet clover is becoming more popular on the project each year. While this crop can not make a permanent pasture, it fits well into a short rotation which furnishes a new pasture field each summer. The main drawback to sweet clover as a pasture crop is the possibility of a failure in getting a stand, which would leave the farm without pasture the following summer. As grasshoppers do not damage sweet clover seriously, a stand of it is not so difficult to get as of alfalfa. Perhaps the best time and method of seeding sweet clover are early in the spring with wheat as a nurse crop.

The following 4-year rotation is suggested for those who wish to grow sweet clover for pasture: (1) Wheat and sweet clover, (2) sweet-clover pasture, (3) potatoes, corn, or beets, and (4) corn or beets. It is evident that sweet clover has a beneficial effect on succeeding crops, just as is the case with alfalfa.

SUGAR BEETS.

TIME-OF-THINNING TEST.

It often happens that laborers contracting to care for sugar beets undertake to handle a larger acreage than they are able to thin before some of the beets become rather large. The object of this experiment was to determine just what effect this late thinning has on the yield. The experiment began in 1917 and was continued during 1918 and 1919. In 1919 this test was conducted on land (field H-VI-VII-north) that was in potatoes the previous year. This land was spring plowed, and the beets were planted May 1. The field was divided into four plats of 36 rows each. On June 10 the first 12 rows in each plat were thinned, on June 20 the second 12 rows, and on June 30 the third 12 rows. In other respects the plats received the same treatment. The stand on these plats was fairly good. The average yield of the rows in the four plats that were thinned on June 10 was 18.79 tons. These thinned on June 20 averaged 16.8 tons, and those thinned on June 30 yielded 13.32 tons per acre. In other words, the yield was cut down 1.19 tons per acre by a delay of 10 days in thinning and 4.28 tons per acre by a delay of 20 days. The results of these experiments for the past three years are given in Table IX.

The average results for three years show that where thinning was delayed 10 days the yield was cut down 1.61 tons per acre, and with a delay of 20 days the yield was reduced 5.09 tons per acre. As shown in Table IX this decrease caused by late thinning has been consistent each year. On the basis of these results 25 acres of beets thinned at the proper time will produce the same tonnage as 34.5 acres thinned 20 days later. When beets are worth $10 a ton and the hauling costs $1 plus the value of the beet tops per ton, the net

profit from beets thinned at the proper time will be $45.80 per acre more than from beets thinned 20 days later. On a 25-acre field this extra profit would amount to $1,145. The time of thinning has more influence on the yield than is generally realized. Early planting and early thinning are recommended.

TABLE IX.—*Yield of sugar beets grown on the Scottsbluff Experiment Farm on plats thinned at different dates in 1917, 1918, and 1919.*

Year.	Average yield per acre (tons).				
	Time of thinning.			Decrease from delay in thinning.	
	Early.	10 days later.	20 days later.	10 days later.	20 days later.
1917	17.16	13.77	9.61	3.39	7.55
1918	19.26	19.02	15.83	.24	3.43
1919	18.79	17.60	14.51	1.19	4.28
Average	18.40	16.80	13.32	1.61	5.09

COMPARATIVE EFFECT OF MANURE AND ALFALFA ON YIELDS OF SUGAR BEETS.

In the irrigated rotations sugar beets are grown on quarter-acre plats in 14 different crop rotations. In four of these rotations the beets receive manure, in four rotations they receive the residual effect of alfalfa, and in six rotations they receive neither manure nor the effect from alfalfa. In three of the manured rotations sugar beets follow the manure, while in one rotation they follow potatoes that have been manured. In two rotations sugar beets follow alfalfa the second season after the alfalfa is plowed up, and in two rotations they follow alfalfa the third season.

The results covering seven years are presented in Table X. The beet crop in 1916 was damaged by hail and is therefore omitted from the table.

TABLE X.—*Comparative effect of manure and alfalfa on yield of sugar beets on the Scottsbluff Experiment Farm from 1912 to 1919, inclusive, omitting 1916.*

Year.	Average yield per acre (tons).				
	Check, 6 plats.	Manured, 4 plats.	Alfalfa, 4 plats.	Increase in favor of—	
				Manure.	Alfalfa.
1912	17.79	21.09	.....	3.30	.....
1913	17.01	22.87	.....	5.87	.....
1914	14.39	18.26	20.92	3.87	6.53
1915	10.73	14.67	14.76	3.94	4.42
1917	11.09	17.16	15.76	6.07	4.67
1918	11.99	21.55	19.08	9.56	7.09
1919	8.13	15.76	16.38	7.63	8.25
Average	13.02	18.96	17.38	5.75	6.19

Table X shows that the increase due to the effect of manure has varied from 9.56 tons in 1918 to 3.3 tons in 1912, with a 7-year average of 5.75 tons per acre. These plats were manured at the rate of 12 tons per acre. On this basis each ton of manure increased the beet yield 0.48 of a ton, or the equivalent of $3.84 when $2 a ton is allowed out of $10 for hauling the extra tonnage of beets.

The increase due to the residual effect of the alfalfa has varied from 8.25 tons in 1919 to 4.42 tons in 1915, with a 5-year average of 6.19 tons per acre. In other words, the residual effect of alfalfa even during the second and third seasons after the alfalfa was plowed up amounted during a 5-year period to a net increase of $49.52 per acre.

The average yield of beets from the manured and the alfalfa plats is slightly more than 18 tons per acre, while the average yield from plats in the rotation without manure or alfalfa for the past five years is a little over 11 tons per acre. It is generally conceded that it requires a 9-ton yield of beets to pay expenses. Anything above 9 tons is profit, while anything under 9 tons is loss. On this basis, the following statement shows the profit per acre from different acre yields:

A yield of 9 tons pays expenses.
A yield of 11 tons pays expenses plus 2 tons for profit.
A yield of 12 tons pays expenses plus 3 tons for profit.
A yield of 15 tons pays expenses plus 6 tons for profit.
A yield of 18 tons pays expenses plus 9 tons for profit.

This statement indicates that the profit from a 15-ton yield is twice as much as from a 12-ton yield, the profit from an 18-ton yield being 4½ times that from a yield of 11 tons. An acre of beets that yields 18 tons gives the same net profit as the yield from 4½ acres that produce 11 tons per acre. On an 80-acre farm where 3 acres are used for buildings and 77 acres for field crops, the crop area may be divided into seven fields of 11 acres each and the following 7-year rotation followed: (1) Small grain and alfalfa, (2) alfalfa, (3) alfalfa, (4) alfalfa, (5) potatoes, (6) beets, (7) beets manured. On this basis the number of profit tons from the 22 acres of beets grown in the sixth and seventh years will amount to 44 tons more than from the entire 77 acres where beets are grown on land that has not recently been manured or in alfalfa. Such a cropping system will not only give 44 more profit-tons of beets than the 1-crop system, but there will be the profit from 11 acres of grain, 33 acres of alfalfa, and 11 acres of potatoes, all grown on good productive land. Such a cropping system will not require as much labor as where the whole farm area is in beets; and the labor and available water required to produce these various crops will be very much better distributed.

EFFECT OF FERTILIZERS ON THE YIELDS OF SUGAR BEETS.

A fertilizing test is being conducted on 39 plats in field F–I. This series of plats is made up of 13 sets of plats in triplicate. Two of these sets, or six plats, are checks which received no manurial treatment. In 1917 five sets of plats received barnyard manure, two sets received bone meal, two sets received dried blood, and two sets received both bone meal and dried blood.

Barnyard manure was applied at the rate of 12, 24, 36, 48, and 60 tons per acre to each set of the manured plats. In the same year bone meal was applied at the rate of 300 pounds and 600 pounds per acre to each of two sets of plats, and dried blood was applied at the rate of 200 pounds and 400 pounds per acre to each of two sets of plats. Also bone meal and dried blood were both applied at the rate of 300 pounds and 200 pounds, respectively, to one set of plats, and the same fertilizers were applied at the rate of 600 pounds of bone meal and 400 pounds of dried blood to another set of plats.

In 1918 no commercial fertilizers were used, but manure was applied at the same rate as in 1917 to one of each of the plats in each of the five sets manured the previous year. In 1918 also manure was applied at the rate of 24 tons per acre to one plat of each of the sets of plats that received bone meal or dried blood, or both, in 1917. Of all the manured or fertilized plats, 22 received no additional application in 1918. Sugar beets were grown on these plats both years.

The yield of sugar beets from the plats receiving barnyard manure showed a considerable increase in 1917. This increase, however, was not in proportion to the quantity of manure applied. Where 12 tons of manure was applied, the increase in yield of sugar beets was 3.1 tons per acre; where 60 tons of manure was applied, the increase was 4.1 tons of beets per acre. Had the 60 tons of manure been applied to 5 acres instead of one the increase in yield of beets due to this same quantity of manure would have been 20.5 tons instead of 4.1 tons. It would seem from these results that where the available manure is limited, and this is the case on most farms, it is better to apply it at the rate of 10 or 12 tons per acre rather than in heavier applications, but in cases where there is an abundance of manure heavy application is advisable.

The plats treated with commercial fertilizer showed a slight increase, but this increase was not so marked as where barnyard manure was used. The average yields from the check plats and from those severally treated with barnyard manure and commercial fertilizers are given in Table XI.

The yields obtained in 1918 show the direct effect of barnyard manure and also the residual effect of both manure and commercial fertilizers. The residual effect of barnyard manure applied in 1917 was to increase the yield of beets 2.4 tons per acre. This same

residual effect plus the direct effect of the manure applied in 1918 is shown in the yield of 4.4 tons per acre, which would indicate that the increase due to the application of additional manure in 1918 was 2 tons per acre. The residual effect of the commercial fertilizer applied in 1917 was to increase the yield 2 tons per acre. On the plats that received commercial fertilizer in 1917 and barnyard manure in 1918 there was an increase of 4.6 tons per acre. By comparison it would seem that 2 tons of this increase was due to the residual effect of the commercial fertilizer. It is not clear just why the commercial fertilizer should show more increase the second year than the first year. The higher general yield in 1918 was due to seasonal conditions.

TABLE XI.—*Effect of the use of commercial fertilizers and barnyard manure on the yield of sugar beets grown on the Scottsbluff Experiment Farm in 1917 and 1918.*

Treatment of plats.	Number of plats.	Average yield per acre (tons).	
		Actual.	Increase.
Season of 1917:			
Check (no fertilizer)	6	14.86	.....
Barnyard manure	15	18.28	3.42
Commercial fertilizers	18	15.96	1.10
Season of 1918:			
Check (no fertilizer)	6	19.4	.....
Barnyard manure in 1917	10	21.8	2.4
Barnyard manure in 1917 and 1918	5	23.8	4.4
Commercial fertilizers in 1917, manured 1918	6	24.0	4.6
Commercial fertilizers in 1917	12	21.4	2.0

VARIETY TEST OF MANGELS.

The variety test of mangels was continued during the summer of 1918. They were grown in field D on land that was in potatoes in 1917. The yields of varieties tested in 1918 and in previous years are shown in Table XII.

TABLE XII.—*Yields of different varieties of mangels on the Scottsbluff Experiment Farm from 1913 to 1918, inclusive, omitting 1916.*

Variety	Yield per acre (tons).					
	1913	1914	1915	1917	1918	Average.
Mammoth Long	36.50	17.80	18.20	24.50	25.00	24.40
Golden Tankard	38.10	14.40	14.50	20.87	29.90	23.55
Giant Eckendorf	.....	.....	.....	28.46	.....	28.46
Danish Sludstrup	.....	19.60	18.40	20.45	30.10	22.14
Giant Half-Sugar	32.00	17.50	22.00	25.01	38.80	27.06

In previous years some trouble has been experienced in keeping mangels through the winter. Each variety that was grown in 1918 was siloed separately. They were treated just as sugar beets are except that more soil was applied as the weather became colder.

Care was taken that none of the mangels were frosted before being covered with soil. On opening these silos toward spring it was found that all varieties had kept exceptionally well. Probably the trouble in previous years has been caused by the mangels being frosted before they were put in the silo. After mangels are frozen it is very difficult to silo them successfully. The Giant Half-Sugar is perhaps the equal of any of the varieties. At Scottsbluff its average yield is higher than that of any other variety.

POTATO VARIETY TEST.

The potato variety test was conducted in 1919 on duplicate tenth-acre plats in field H–III on land that was used in growing small grain in 1918. Prior to 1917 this land was in alfalfa. The stubble was plowed in the fall. The potatoes were planted on May 27, the seed of each variety being first treated with corrosive sublimate. The average yields from these duplicate plats obtained in 1917, 1918, and 1919 are presented in Table XIII.

TABLE XIII.—*Yields of potato varieties grown on the Scottsbluff Experiment Farm in 1917, 1918, and 1919.*

Variety.	Average yields per acre (bushels).							
	1917		1918		1919		3-year average.	
	Culls.	Marketable.	Culls.	Marketable.	Culls.	Marketable.	Culls.	Marketable.
Triumph	39.0	417.0	26.2	261.1	28.6	260.8	31.3	312.9
Downing	30.4	424.7	24.0	409.0	65.9	251.1	40.1	361.6
Eureka [1]	31.4	376.1	31.2	323.9	25.1	299.4	29.3	333.1
Pearl	35.3	297.5	13.7	285.8	23.1	142.1	24.0	241.8
Early Ohio	45.8	350.6	22.7	299.7	.....	.....	34.3	325.1
Rural New Yorker No. 2	41.6	443.3	.....	.....	26.8	282.7	34.2	363.0
King	.....	.....	.....	.....	32.1	179.4	32.1	179.4

[1] Probably the Irish Cobbler variety.

The quality of the potatoes grown in 1919 was very good, much better than that of the same varieties grown the previous two years. All of the seed used in 1919 was shipped into the valley, while that used in 1917 and 1918 was of varieties that had been grown at the station for a number of years. In 1917 and 1918 the potatoes were grown on alfalfa land, but the land used for potatoes in 1919 had not been in alfalfa for three years. A good stand was obtained on all plats except where the Pearl and the King were planted. On the Pearl plats there was not more than one-third of a stand, and on the King plats about two-thirds of a stand.

The most striking feature in this variety test is the marked variation within the same variety from year to year. There seems to be a wider variation within a variety than there is between different varieties.

In growing potatoes the matter of seed is a very important factor. Good seed of a poor variety will give better results than poor seed of a good variety. It is very difficult to grow a good potato crop from poor seed, no matter what the variety. The question of variety, however, is not to be disregarded. The variety should be (1) the kind of potato that the public demands and (2) one that will mature so early that the crop can be harvested before it is damaged by frost.

In the North Platte Valley the Downing, the Eureka, the Pearl of the white type, and the Triumph of the red type are giving very satisfactory results when good seed is planted. The Downing matures a little earlier than either of the other white varieties, and the Triumph matures a little earlier than the Downing. The Rural New Yorker No. 2 and the King will perhaps yield a little heavier than some of the other varieties, but they are rather late in maturing and are too often damaged by frost. While the Early Ohio is an early-maturing variety it is not recommended for irrigated land. When grown under irrigation it is usually very rough and knobby.

Tests have been conducted to determine how late it is safe to plant potatoes. The results from these tests show that, as a general rule, the later plantings give smaller yields, but the tubers are of better grade. The difficulty in late planting is to get seed that will grow. If good seed is available, potatoes are perhaps as good, if not better, than any other crop to plant on blown-out beet land. In 1917 very good yields were obtained from plantings made as late as July 2. Potatoes planted so late will not mature sufficiently for the general market, but they can be used for seed the following year.

EFFECT OF ALFALFA ON SUCCEEDING CROPS.

In field K–V during the summers of 1914 and 1915, 8 plats of alfalfa were pastured with hogs, and 2 plats were harvested for hay. The 10 plats were plowed in the spring of 1916 and planted to potatoes. In 1917 they were seeded to beets, in 1918 to oats, and in 1919 to barley. Grasshoppers damaged the grain crops each year, but so far as could be observed the damage was nearly the same on all plats. The yields from the pastured plats were consistently higher each year than from the unpastured plats. The average yields from the pastured and unpastured plats for each year are shown in Table XIV.

TABLE XIV.—*Comparative yields of potatoes, sugar beets, and grain grown on alfalfa-hay land and on alfalfa-pasture land on the Scottsbluff Experiment Farm from 1916 to 1919, inclusive.*

Alfalfa land.	Number of plats.	Average yield of crop.			
		Potatoes in 1916.	Beets in 1917.	Oats in 1918.	Barley in 1919.
		Bushels.	*Tons.*	*Bushels.*	*Bushels.*
Pastured with hogs	8	316.1	18.29	79.5	41.9
Harvested for hay	2	288.8	16.72	60.8	23.4
Excess of yield from pastured land	.....	27.3	1.57	18.7	18.2

EFFECT OF ALFALFA AND MANURE ON SUCCEEDING CROPS.

In the irrigated rotation experiments there are 13 plats of potatoes, each grown in a different crop rotation. In four rotations potatoes follow alfalfa. In three rotations they are manured and in six others the rotations in which they are grown do not include alfalfa or receive manure. The average yields from the plats receiving different treatments for each year from 1913 to 1919 are indicated in Table XV.

TABLE XV.—*Effect of manure and the growing of alfalfa on the yields of potatoes on the Scottsbluff Experiment Farm from 1913 to 1919.*

Year.	Average yields per acre (bushels).				
	Check, 6 plats.	Manured, 3 plats.	Alfalfa land, 4 plats.	Increase in favor of—	
				Manure.	Alfalfa.
1913	260.8	339.2	376.6	78.4	115.8
1914	149.8	244.6	292.7	94.8	152.9
1915	105.9	156.6	221.2	50.7	115.3
1916	197.8	205.0	304.4	7.2	106.6
1917	139.2	193.6	295.1	54.4	155.9
1918	90.1	122.6	223.2	32.5	133.1
1919	117.1	191.6	262.2	74.5	145.1
Average	151.5	207.6	282.2	56.1	132.1

The increased yield of potatoes due to the residual effect of alfalfa varied from 106 bushels per acre in 1916 to 155.9 bushels per acre in 1917, with a 7-year average of 132.1 bushels per acre. The manured plats show a 7-year average increase of 56.1 bushels per acre. The increase caused by alfalfa is more than twice as much as the increase caused by manure. In cases where both alfalfa and manured land are available and both potatoes and beets are to be grown, the best results will be obtained by putting potatoes on the alfalfa land and beets on the manured land.

CORN.

WHERE TO OBTAIN SEED CORN.

Although the North Platte Valley is 4,000 feet above sea level, corn in most years matures well. It is necessary, however, to plant early-maturing varieties. A safe practice is to procure seed from some farmer in the neighborhood who has grown corn successfully for years. Getting seed from a section with a longer growing season is a mistake too often made in trying to obtain a higher yielding variety. Such seed when brought into a district with a short growing season fails to mature. Tests at the experiment farm have shown that corn of the same variety when grown under different climatic conditions becomes gradually adapted to its environment and in so doing acquires distinct characteristics. This was shown by a test

made during the summers of 1917 and 1918 when Calico corn that had been grown for years in the eastern part of Nebraska was grown side by side with Calico corn that had been planted in the North Platte Valley for some 15 or 20 years. These two strains originally came from the same source. The eastern strain grew much taller and had larger ears than the local strain. However, the corn from the local-grown seed was well matured by the middle of September, while that from the eastern-grown seed was still green. Even in 1918, when killing frost did not occur until October 26, the corn from the eastern-grown seed was but little past the dough stage. The average yields from these two strains of Calico corn during the years 1917 and 1918 were 66.9 bushels per acre of well-matured corn from the locally grown seed and 48.1 bushels per acre of very soft corn from the eastern-grown seed. When it is desired to try a new variety from a section where the growing season is longer, it should be tested on a small scale the first year or two.

FIELD-CORN VARIETAL TESTS.

Local varieties of corn that have been grown in the North Platte Valley for a number of years were used in this test. The names applied to some of these varieties are those of the farmers from whom the seed was obtained and who have grown and selected these particular strains for some years past. Each variety was planted on four tenth-acre plats of fall-plowed stubble land in field H–IV–V. The average yields from the plats for 1917, 1918, and 1919, together with the 3-year average, are shown in Table XVI.

TABLE XVI.—*Yields of varieties of corn grown on the Scottsbluff Experiment Farm during 1917, 1918, and 1919.*

Variety or strain.	Average yield per acre (bushels).			
	1917	1918	1919	Average.
Dry-Land White	71.5	66.4	51.9	63.3
Calico (local)	55.1	78.4	47.6	60.4
Youngheim White	60.4	54.2	47.8	54.1
Sands White	61.1	61.1	39.9	54.0
Sands Yellow	53.8	47.8	.....	50.8
Elder White	.....	74.3	48.4	61.4
Lovelace Yellow	.....	61.1	50.8	56.0

Both the Dry-Land White and the Calico varieties have been grown on the experiment farm during each of the past eight years, the former under dry-land conditions and the latter under irrigation. At the beginning, both were obtained from local farmers. The Sands White and the Sands Yellow were obtained from a Mr. Sands, of the Gering Valley, who has grown the white variety for many years and the yellow variety for a shorter period. As Mr. Sands had discontinued growing the yellow variety in 1918, no seed was available for

the 1919 variety test. The Youngheim White corn has been grown by a Mr. Youngheim on his farm north of Mitchell for a number of years. The Elder White corn has been grown for about 10 years by a Mr. Elder on his farm just west of the experiment farm. The Lovelace Yellow corn has been grown in the Gering Valley for many years by a Mr. Lovelace, of Mitchell.

SILAGE TEST.

A test of the yields of different silage crops has been conducted during the past three years. This test has included sunflowers, silage corn (Nebraska White or Hogue Yellow), and local field corn. In 1919 this test was conducted on duplicate tenth-acre plats on field I–I, where barley had been grown the previous year. The land was manured in the spring at the rate of about 12 tons of barnyard manure per acre. The crops were planted on May 17. The field corn was harvested on September 22, and the silage corn and sunflowers on September 27. The field corn, and perhaps the sunflowers, should have been harvested sooner, for the corn was well matured and the sunflowers were at least in the dough stage. The delay was caused by lack of help. The silage corn was just beginning to dent well. At the time the sunflowers were siloed about 10 per cent, by weight, of sugar-factory molasses was added to the silage. Pit silos were used. The average yields from these plats, figured to an acre basis, together with the average yields for 1917 and 1918, are shown in Table XVII.

TABLE XVII.—*Yields of corn and sunflowers used for silage on the Scottsbluff Experiment Farm in 1917, 1918, and 1919.*

Crop.	Yield per acre (tons).			
	1917	1918	1919	Average.
Sunflowers	22.93	11.66	14.35	16.31
Silage corn	16.40	12.88	14.64	14.64
Field corn (local)	10.92	7.36	9.39	9.22

The sunflowers were badly damaged in 1918 and 1919 by grasshoppers eating the terminal bud, thus stopping the growth of the plant. The damage to the corn was not so great. Perhaps the yields obtained from these crops in 1917 are more representative of what may be expected under favorable conditions than are the 3-year average yields. The tonnage from sunflowers under favorable conditions will be much higher than from corn, but corn seems to withstand attacks from pests and injury from drought better than sunflowers. It is claimed for sunflowers that they can be grown more profitably than corn in sections having a very short growing season.

The ensilage from these yield tests has been fed each year. In filling the silo in 1917 the corn and sunflowers were placed in layers

of about 4 feet. This was done to see whether the cows would show any preference for either and whether a change from one to the other would cause any fluctuation in the milk flow. The cows did show a preference in favor of the corn silage. While they ate the sunflower silage very well, they would not eat so much of it as of the corn silage. There was no noticeable fluctuation in the milk flow. In 1918 one silo was filled with corn and the other with both corn and sunflowers, the sunflowers being put on the bottom and the corn used to finish filling the silo. The sunflowers filled about two-thirds of the silo. This silage was fed to dairy cows and to a pen of mixed dairy stock that was being fattened. The corn silage was fed first. When the change was first made both cows and fattening stock ate the sunflower silage very well, but after being fed the sunflower silage for ten days or two weeks they would not eat so much. It seemed that for some reason the longer they were fed sunflowers the less they would clean up. The cows also dropped in their milk flow. In 1919 the 1918 plan of filling the two silos was followed except that about 10 per cent, by weight, of molasses from the sugar factory was added to the sunflowers. This was fed to dairy cows, beef steers, and fattening lambs. All of the live stock ate the sunflower silage fairly well, but even with the sirup they did not relish it so well as they did the corn silage.

Results covering three years indicate that sunflowers will yield more than silage corn and that silage corn will outyield field corn. The quality of the ensilage from each of these crops must also be considered. If the ensilage from field corn has no more feeding value than ensilage made from silage corn, then 10 acres of silage corn will produce as much feed as 15 acres of field corn on the basis of the 1917 yield; and if the ensilage from sunflowers is as good as that made from field corn, then 10 acres of sunflowers will produce as much feed as 20 acres of field corn. As field corn has a higher percentage of ears to stalks than ensilage corn, it is reasonable to believe that field-corn ensilage has a higher feeding value than silage-corn ensilage. Numerous experiments have shown this to be true. It is also believed that ensilage made from the silage corn has a higher feeding value than ensilage made from sunflowers, but no definite statement can be made until more experimental work has been done. It is a fact, however, that stock show preference for corn silage.

On a ton basis, therefore, there is little doubt as to which of these different silage crops is the best, but on an acre basis there is still some difference of opinion. From the data available at this experiment farm it is believed that the extra tonnage from silage corn over that from field corn will more than make up for the better quality of the field corn. It is further believed that the ensilage from silage corn is sufficiently higher in quality to offset the greater yield of sunflowers.

Sunflowers require about the same cultural treatment as corn. They are planted with a corn planter, cultivated with a corn cultivator, and, if they stand up well, can be harvested with a corn binder. If they become tangled or if they lean to any great extent, they must be cut by hand. Sunflowers are more difficult to handle than corn.

As sunflowers require no machinery other than that used in growing corn, it may be well for farmers who grow ensilage crops to plant a small area to sunflowers as a test for future guidance.

SMALL GRAINS.

The small-grain variety tests in 1919 were conducted in field D on land that was in sugar beets and mangels in 1918. This land was double disked, harrowed, and floated. Each variety of grain was treated with formaldehyde before being seeded. Small grain suffered badly from lack of moisture during its early stage of growth. This was caused by lack of the usual spring rains and a shortage of irrigation water. Later in the season grasshoppers invaded the field in large numbers. Large quantities of poison bait were put out, but with very little success. Experiences at the experiment farm have shown that poison-bran bait is not very effective in combating grasshoppers in fields of small grain. The damage caused by drought and grasshoppers makes the yields obtained from the different grain varieties of little significance.

WHEAT VARIETAL TESTS.

Four varieties of wheat were seeded on duplicate tenth-acre plats. The results are recorded in Table XVIII.

TABLE XVIII.—*Yields of wheat varieties grown on the Scottsbluff Experiment Farm in 1917, 1918, and 1919.*

Varieties.	Yields per acre (bushels).			
	1917	1918	1919	Average.
Galgalos	49.4	47.0	24.3	40.1
Defiance	50.2	34.3	18.9	34.5
Beloturka	52.9	31.4	19.9	34.7
Arnautka	52.4	35.4	.....	43.9
Marquis	.....	42.4	25.8	34.1

The Beloturka and Arnautka durum wheats often lodge very badly when grown on rich soil. The Galgalos, Defiance, and Marquis varieties stand up better than durum wheats.

BARLEY VARIETAL TESTS.

In 1919 only two varieties of barley were grown. Each variety was seeded on duplicate tenth-acre plats on April 28. The results are recorded in Table XIX.

TABLE XIX.—*Yields of varieties of barley on the Scottsbluff Experiment Farm in 1917, 1918, and 1919.*

Varieties.	Yields per acre (bushels).[1]			
	1917	1918	1919	Average.
Trebi	79.4	79.5	53.2	70.7
Barbary	63.2	70.9	51.7	61.9
Franconia	56.2	.....	.....	56.2
Svanhals	60.4	56.7	.....	58.5
Hooded	37.3	.....	.....	37.3
Bald	37.2	.....	.....	37.2

[1] The Hooded and Bald barleys are figured on the basis of 60 pounds per bushel, the others at 48 pounds per bushel.

The Trebi barley is proving to be a very good variety for irrigated land. Not only does it yield much more than any of the other varieties, but it is of unusually good quality and thrashes well. A rather large quantity of seed of this variety has been distributed among the farmers on the project during the past two years. Most farmers report very satisfactory yields and are well pleased with the results obtained.

OATS VARIETAL TESTS.

Four varieties of oats were tested in 1919. They were seeded on April 28 on duplicate tenth-acre plats. The results for the three years are recorded in Table XX.

TABLE XX.—*Yields of varieties of oats grown on the Scottsbluff Experiment Farm in 1917, 1918, and 1919.*

Varieties.	Yields per acre (bushels).			
	1917	1918	1919	Average.
Newmarket	76.4	68.2	36.9	60.5
Swedish Select	70.0	74.2	31.0	58.4
Canadian	69.9	.....	.....	69.9
Big Four	68.3	77.9	.....	73.1
Kherson	64.4	83.3	35.5	61.1
White Kherson	.....	90.9	39.1	65.0

The Kherson and the White Kherson varieties of oats are to be recommended in most cases. They mature early, thus lessening the risk of hailstorms and damage from grasshoppers. Where alfalfa is seeded with the oats the grain can be taken from the field sooner, thus giving the young alfalfa a better chance to become established.

CULTURAL TREATMENT TESTS.

The question is often asked by farmers "Should I plow, disk, or spring-tooth corn-stubble land on which I am going to seed oats or barley?" To obtain information along this line, tests were conducted during the summer of 1917, 1918, and 1919. In each case the land

had been used in growing corn the previous year. This corn-stubble land was divided into tenth-acre plats, one-third of which were plowed, one-third disked, and one-third spring-tooth harrowed. In each case this was done in the spring just before seeding the grain. On half of these plats, usually nine in number, three of which had been plowed, three disked, and three harrowed, oats were seeded, and on the other nine plats barley was seeded. Kherson oats were used each year. Franconia barley was sown in 1917, and Trebi barley in 1918 and 1919.

In 1919 this test was conducted on field H–IV–V. The grain was treated with formaldehyde before seeding, on April 28. Grasshoppers did not do much damage to this field. The average yields of oats for each year from each of the different cultural-treatment tests are given in Table XXI.

TABLE XXI.— *Yields obtained in tests of the cultural treatment of oats on the Scottsbluff Experiment Farm in 1917, 1918, and 1919.*

Cultural treatment of plats.	Yields per acre (bushels).			
	1917	1918	1919	3-year average.
Plowed	88.1	84.6	60.9	77.9
Disked	84.4	96.5	63.5	81.5
Spring-tooth harrowed	86.0	93.4	68.4	82.6

The results from the tests covering three years seem to show that plowing corn-stubble land has no advantage over either disking or spring-tooth harrowing for oats and that the treatments other than plowing are much quicker and cheaper.

The average yields of barley under each of the different cultural treatments for each year are recorded in Table XXII.

TABLE XXII.— *Yields obtained in tests of the cultural treatment of barley on the Scottsbluff Experiment Farm in 1917, 1918, and 1919.*

Cultural treatment of plats.	Yields per acre (bushels).			
	1917	1918	1919	3-year average.
Plowed	60.9	79.4	60.4	66.9
Disked	58.3	80.2	57.7	65.4
Spring-tooth harrowed	51.9	75.0	61.2	62.7

The average results of the three years show a slight increase for the plowed plats. This amounts to only 1.5 bushels per acre more than the disked plats, which will hardly make up for the difference in the cost of operation. When cost is considered, it would seem that disking is the best method of preparing corn-stubble land for the seeding of either oats or barley.

COMPARISON OF OATS AND BARLEY.

As the oats and the barley in the cultural-treatment tests were each grown under the same conditions each year, the yields obtained afford a very good comparison. In each case the yields represent the average of 27 plats, or 9 plats for three years. The average yield of the 27 oat plats and the average yield of the 27 barley plats are recorded in Table XXIII.

TABLE XXIII.—*Comparative yields of oats and of barley grown under the same conditions on the Scottsbluff Experiment Farm in 1917, 1918, and 1919.*

Crop.	Yields per acre.	
	Bushels.	Pounds.
Oats	80.7	2,582
Barley	65.0	3,120
In favor of—		
Oats	15.7	.....
Barley	.....	538

As the average yield of oats was 80.7 bushels per acre, as against 65 bushels of barley, it may appear that oats is a higher yielding crop than barley, but it must be remembered that 2 bushels of barley weigh the same as 3 bushels of oats. While the results from this test show a yield of 15.7 bushels per acre in favor of the oats, the barley actually outyielded the oats 538 pounds per acre. In many cases barley will prove a more profitable crop to grow than oats. It should be ground before being fed.

EFFECT OF ROTATIONS.

The oats in the irrigated rotations were damaged badly by grasshoppers in 1918 and 1919. The average yield from the 18 plats was 65.6 bushels per acre in 1918 and 48.5 bushels in 1919. The yield from the plats that had received manure averaged 11.9 bushels in 1918 and 2.3 bushels in 1917 more than similar plats not receiving it. Where oats followed alfalfa land the yield was greater by 16.5 bushels per acre in 1918 and by 7.2 bushels in 1919.

Wheat following alfalfa made a yield of 31 bushels per acre in 1918, and 23.3 bushels in 1919, as compared with 23 bushels in 1918 and 13.1 bushels in 1919 where wheat followed oats in a 2-year rotation.

DRY-LAND FARMING.[1]

Many farmers on the North Platte Reclamation Project have dry land in connection with their irrigated land. As a rule this land is used as pasture, and in too many instances it is so badly overpastured that it produces but little feed. Much of the land is tillable

[1] This summary of results was prepared by the Office of Dry-Land Agriculture.

and might be made a source of greater income than it provides as native pasture.

To determine the agricultural possibilities of the unirrigated land and the best methods of cultivation and crop rotation to practice on such land, the Office of Dry-Land Agriculture is conducting investigational work on the Scottsbluff Farm. About 150 tenth-acre plats are used of land that has never been irrigated. The work consists principally of experiments with crop rotations and methods of tillage. The principal crops used are corn, winter wheat, spring wheat, oats, barley, and sorghum. The results obtained will not be considered in detail in this report, but it may be of value to refer to some of the more important of them.

Table XXIV presents the average yields of the several crops from all methods for each year of the 9-year period from 1911 to 1919, inclusive. In 1911 the crops were all on virgin prairie sod broken in the summer of 1910. The low yields were due to drought. Because only one method was under trial in this the first year of the experiments, only the eight years, 1912 to 1919, inclusive, are considered in studying the results of different methods.

TABLE XXIV.—*Average yields of the several crops grown without irrigation on the Scottsbluff Experiment Farm for the 9-year period from 1911 to 1919, inclusive.*

Year.	Average yields per acre.					
	Winter wheat.	Spring wheat.	Oats.	Barley.	Corn.	Sorghum.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Pounds.*
1911	3.0	1.9	0	2.0	7.4	3,067
1912	13.3	17.0	34.3	26.7	36.7	10,400
1913	10.0	11.5	25.0	0	30.3	6,400
1914	22.1	10.7	17.3	7.7	10.2	250
1915	22.2	18.1	52.6	38.8	12.9	7,700
1916	5.7	8.2	10.4	8.4	29.1	8,800
1917	6.9	15.6	24.4	15.5	26.7	8,107
1918	0	11.4	25.8	17.1	18.2	4,110
1919	4.5	2.3	2.8	4.7	5.0	2,417
Average	9.7	10.7	21.4	13.4	19.6	5,695

The average yield of winter wheat for the nine years was 9.7 bushels per acre, which is 1 bushel less than the average yield of spring wheat for the same period. This lower average of winter wheat is due either to complete winterkilling, as in 1918, or to winterkilling on some methods of preparation in other years. When the crop comes through the winter it generally yields more than spring wheat. When the winter-wheat crop is credited with the spring wheat produced by reseeding winterkilled plats, its average is higher than that of spring wheat.

The 8-year average yield of winter wheat on fallow was 16.5 bushels, and on disked corn ground 13 bushels, while on land con-

tinuously cropped to winter wheat the yield was only 6 bushels on early fall plowing and 3.6 bushels on late fall plowing. These averages include the spring wheat produced in two years of partial or complete winterkilling.

Spring wheat averaged 10.7 bushels per acre for the nine years. There were two years when the yield was so low as to amount to practical failure. For the period from 1912 to 1919 three plats on fallow ground averaged 16.2 bushels per acre. On disked corn ground 11 plats averaged 12.5 bushels. The yield on fall-plowed corn ground was 12.6 bushels and on spring-plowed corn ground 11 bushels. Other yields were 10.6 bushels on fall-plowed oat ground, 9.9 bushels on spring-plowed oat ground, and 9.9 bushels on spring-plowed sorghum ground. On land continuously cropped to wheat the yield fell to 7.1 bushels on fall plowing and 6.4 bushels on spring plowing.

The average yield of oats for the 9-year period was 21.4 bushels per acre. The 8-year average on fallow ground was 30.9 bushels, on disked corn ground 25.8 bushels, on spring-plowed corn ground 23.5 bushels, on spring-plowed wheat ground 22.9 bushels, and on fall-plowed wheat ground 18.5 bushels, while land continuously cropped to oats averaged only 16.1 bushels on fall plowing and 17.2 bushels on spring plowing. A single plat on spring-plowed sorghum ground yielded 25.8 bushels per acre.

The 9-year average yield of barley was 13.4 bushels. The 8-year average yield on fallow ground was 26 bushels, on spring-plowed oat ground 16.7 bushels, on disked corn ground 15.4 bushels, and on land continuously cropped to barley 15.4 bushels on spring plowing and 12.1 bushels on fall plowing.

The 9-year average yield of corn was 19.6 bushels. Two crops were very poor, but in the other seven years the average yields ranged from 10.2 to 36. 7 bushels. Only one plat of corn was grown on fallow ground and its average for eight years was 28.2 bushels. Outside of this plat the range in yield, due to differences in the preceding crop or the time of plowing, was so small as to be insignificant. The 8-year average yield of all methods other than fallow was 21.4 bushels per acre, and the greatest departure from it was on land continuously cropped to corn with fall plowing, which averaged 23 bushels per acre. In addition to the grain the corn averaged 1,900 pounds of stover per acre.

Three rotations in the experiments contain sorghum. The 9-year average yield of hay or forage from this crop was 5,695 pounds per acre. Only one year showed a production of less than 1.5 tons. That was in 1914, when the crop was seeded solid with a grain drill. It has been found better to plant sorghum in rows with a corn or sugar-beet planter and cultivate it. The heaviest yield was on spring-plowed corn ground manured; this for eight years averaged 6,884 pounds, or nearly 3.5 tons, per acre.

Red clover has consistently resulted in total failure. Brome-grass has not made a stand when seeded with a crop of grain. When seeded alone it has made a sod that in the second and third years averaged from 700 to 800 pounds of hay, but has never yielded as high as three-quarters of a ton. It possesses some possibilities for pasture, being especially valuable for late or very early pasture. Alfalfa has been somewhat more productive than brome-grass, its average yield being about 1,200 pounds of hay per acre.

The increased yields obtained by breaking up alfalfa under irrigation are not evidenced on dry land. Following alfalfa or brome-grass the soil is so dry that the yields are likely to be decreased rather than increased.

It appears from the evidence obtained from the experiments without irrigation that the small grains can be successfully grown on either fallow ground or following corn, but that their yields following small grains are too low to warrant their growth in such combinations unless at seeding time the soil is thoroughly wet to a depth of at least 3 feet. Fallow land should be seeded to winter wheat.

Corn did not show sufficient increase on fallow ground to justify fallowing for that crop. Corn can be grown continuously on the same land if one so desires. The crop on land so treated was somewhat heavier than on land following the small grains. In rotation with the small grains the average yield of corn was more than 21 bushels of grain and nearly a ton of stover per acre.

For forage alone sorghum is the most productive and the surest crop that has been grown. It should be expected to produce from 2.5 to 3 tons of forage per acre.

A good combination of feed crops is a 3-year rotation of oats on spring-plowed sorghum ground, corn on fall plowing, and sorghum on spring plowing. If corn is wanted for feed to use with alfalfa hay produced under irrigation, the dry land can be profitably utilized by cropping it continuously to corn. If a combination of feed and a cash crop is desired, the indicated rotation is a very simple one of corn on either fall or spring plowing and wheat on disked corn ground.

FEEDING LAMBS.[2]

During the winter of 1919–20 12 lots of 31 lambs each were used in a feeding test. The lambs cost $12.75 per hundredweight at Denver, with freight paid to Omaha. At Denver the lambs averaged 47½ pounds each. When weighed into the feed lots they averaged 43½ pounds, having shrunk 4 pounds. They were dipped before being shipped out of Denver. When the shrinkage and cost of dipping were charged against the lambs it made them cost $14.13 per hundredweight in the feed lots at the beginning of the experiment.

[2] This experiment was conducted for and under the supervision of the Nebraska Agricultural Experiment Station.

The lambs in each lot were fed all the alfalfa hay they would eat. The lots getting beet tops were also fed all the tops they would clean up. Silage was fed at the rate of 2 pounds for each lamb daily. The corn and dried pulp were fed at the rate of 1 pound per lamb daily and the cottonseed cake at the rate of one-third of a pound, except in the case of lot 7, where the lambs were fed cake at the rate of half a pound a day.

The lambs were on feed 100 days. At the end of the experiment they were appraised by two experienced sheepmen from a commission company in Omaha. In figuring the net profit for each lamb a 6-pound allowance was made to cover the shrinkage and other items of expense between the feed lots and the market at Omaha. Nine lots of the best lambs were sold on the Omaha market for $19.25 per hundredweight six days after being appraised at the feed lots; the market advanced more than a dollar in this week. The net profit per lamb, therefore, was considerably more than is shown in the summary in Table XXV.

TABLE XXV.—*Summarized results of feeding 372 lambs in 12 lots with different rations for 100 days on the Scottsbluff Experiment Farm during the winter of 1919–20.*

Lot.	Feed consumed per 100 pounds of gain.						Total gains made.	Cost of feed per 100 pounds of gain.	Appraised value per hundredweight.	Net profit per lamb.
	Alfalfa hay.	Corn.	Cottonseed cake.	Dried pulp.	Beet tops (from tons of beets).	Silage.				
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			
No. 1	503	306	.....	.....	.....	.....	971	$12.89	$17.50	$1.83
No. 2	408	246	76	.....	.....	.....	1,205	13.62	18.00	2.32
No. 3	547	[a] 107	.....	[b] 224	.....	.....	928	11.39	17.75	2.40
No. 4	396	[a] 84	[b] 77	175	.....	.....	1,182	11.93	18.00	2.94
No. 5	482	328	.....	.....	.....	.....	923	9.59	17.65	2.91
No. 6	416	.....	79	261	.....	.....	1,162	11.26	17.90	3.02
No. 7	452	.....	[c] 104	247	.....	.....	1,228	12.36	18.00	2.87
No. 8	235	.....	70	231	.....	417	1,307	10.57	18.10	3.80
No. 9	485	.....	120	.....	.....	719	759	11.86	17.00	1.50
No. 10	391	255	.....	.....	1.63	.....	1,162	12.16	17.75	2.59
No. 11	350	.....	73	242	1.71	.....	1,250	11.85	17.85	2.95
No. 12	630	.....	120	.....	2.99	.....	759	13.13	17.25	1.34

[a] Fed 40 days. [b] Fed 60 days. [c] At the rate of half a pound per lamb per day.

The prices were as follows: Corn, $2.90 per hundredweight; dried pulp, $35 per ton; cottonseed cake, $85 per ton; silage, $8 per ton; beet tops, $1 per ton yield of beets; alfalfa hay, $16 per ton.

The results of this feeding test are grouped in Table XXVI, to show the comparative values of the different rations.

Corn in each case made more gain than dried pulp, but at a greater cost and with a lower profit. Cottonseed cake increased the gains with a higher cost and a greater profit. Beet tops proved a cheaper feed than corn but more expensive than dried pulp. Silage produced greater gains than beet tops, with a lower cost and a higher profit. The half-pound ration of cottonseed cake produced a greater

gain at a higher cost and a lower profit than the lighter ration of cottonseed cake.

TABLE XXVI.—*Comparative results of using different rations in feeding 372 lambs on the Scottsbluff Experiment Farm during the winter of 1919–20.*

Feeds compared.	Apportionment of rations.	Total gains made (pounds).	Cost of feed per 100 pounds of gain.	Appraised value per hundredweight.	Net profit per lamb.
Corn and dried pulp (without cottonseed cake):					
Lot No. 1	Corn	971	$12.89	$17.50	$1.83
Lot No. 3	Dried pulp and corn	928	11.39	17.75	2.40
Lot No. 5	Dried pulp	923	9.59	17.65	2.91
Corn and dried pulp (with cottonseed cake):					
Lot No. 2	Corn and cottonseed cake	1,205	13.62	18.00	2.32
Lot No. 4	Dried pulp, corn, and cottonseed cake	1,182	11.93	18.00	2.94
Lot No. 6	Dried pulp and cottonseed cake	1,162	11.26	17.90	3.02
Corn with and without beet tops:					
Lot No. 10	Corn and beet tops	1,162	12.16	17.75	2.59
Lot No. 1	Corn	971	12.89	17.50	1.83
Other feeds with and without beet tops:					
Lot No. 11	Dried pulp, cottonseed cake, and beet tops.	1,250	11.85	17.85	2.94
Lot No. 6	Dried pulp and cottonseed cake	1,162	11.26	17.90	3.02
Beet tops and silage (with other feeds):					
Lot No. 11	Dried pulp, cottonseed cake, and beet tops.	1,250	11.85	17.85	2.94
Lot No. 8	Dried pulp, cottonseed cake, and silage	1,307	10.57	18.10	3.80
Beet tops and silage (with cottonseed cake):					
Lot No. 12	Cottonseed cake and beet tops	759	13.13	17.25	1.34
Lot No. 9	Cottonseed cake and silage	759	11.86	17.00	1.50
Dried pulp, with heavy and with light feed of cottonseed cake:					
Lot No. 7	Dried pulp, with heavy feed of cottonseed cake.	1,228	12.36	18.00	2.87
Lot No. 6	Dried pulp, with light feed of cottonseed cake.	1,162	11.26	17.90	3.02

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